

Application Number 10/626,217
 Amendment dated 28 September 2004
 Reply to Office Action of 30 June 2004

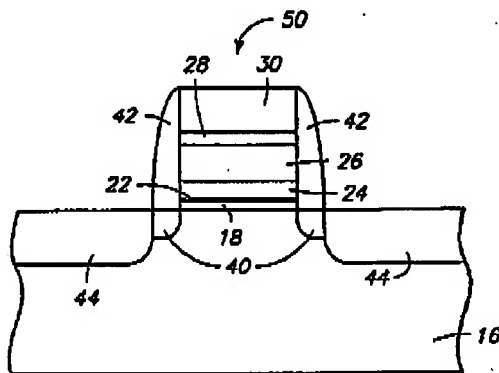
Remarks

Claims 1–15 are pending in this application. Claims 1 and 9 are independent; Claims 2–8 depend from Claim 1, and Claims 10–15 depend from Claim 9.

Claim Rejections Under 35 U.S.C. § 102.

Claims 1, 9, 10 and 15 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent 6,649,543 ("Moore"). Claims 1 and 9 are independent; Claims 10 and 15 depend from Claim 9.

Moore discloses methods of forming transistor devices, such as that illustrated in Figure 7 of Moore, which is reproduced below. In Moore's method, an oxide layer 18 is formed over a semiconductor substrate 16 (3:3–4). Nitrogen-comprising region 22 is then formed on and/or within the oxide layer 18 by exposing the oxide layer 18 to an activated nitrogen species (3:14–18). Silicon nitride layer 24 is then formed over the nitrogen-comprising region 22 using a chemical vapor deposition ("CVD") process (5:31–38). A "conductively" doped silicon layer 26 is then deposited over the silicon nitride layer 24 (6:13–19). In this structure, layers 18/22/24 form a composite dielectric structure (6:10–13).



Claim 1. In contrast to the methods disclosed in Moore, Applicants have amended Claim 1 to recite:

Claim 1 (currently amended): A method of forming a transistor gate stack, the method comprising:

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forming a gate dielectric over a semiconductor substrate;
exposing the gate dielectric to a source of nitrogen excited species, wherein exposing incorporates less than about 10 atomic % nitrogen at a depth of greater than about 10 Å from an upper surface of the gate dielectric; and

depositing a silicon-containing gate electrode over the gate dielectric after exposing the gate dielectric to the source of nitrogen excited species, wherein the gate electrode contacts a portion of the gate dielectric exposed to the source of nitrogen excited species.

Moore does not teach these limitations. Specifically, Moore teaches that the gate electrode 26 contacts the silicon nitride layer 24 (which is part of the gate dielectric 18/22/24). However, Moore contains no teaching that the silicon nitride layer 24 is ever exposed to an activated nitrogen species. Rather, Moore teaches that only the oxide layer 18 is exposed to an activated nitrogen species, but Moore's gate electrode 26 contacts the intervening silicon nitride layer 24, contrary to Claim 1. Therefore, Moore does not teach that "the gate electrode contacts a portion of the gate dielectric exposed to a source of nitrogen excited species," as recited in amended Claim 1.

In view of the foregoing, Applicants submit that Moore does not anticipate Claim 1, and therefore respectfully suggest that Claim 1 is allowable over Moore and request that this rejection be withdrawn.

Claims 9, 10 and 15. In contrast to the methods disclosed in Moore, Applicants have amended Claim 9 to recite:

Claim 9 (currently amended): A method of forming a transistor gate stack, the method comprising:

forming an oxide layer over a semiconductor substrate;
exposing an upper surface of the oxide layer to products of a plasma, such that less than 10 atomic % of the products of the plasma are incorporated into the oxide layer at a depth of greater than about 10 Å from the upper surface; and
depositing a silicon-containing gate electrode over the upper surface after exposing the upper surface to the products of the plasma, such that the gate electrode contacts the upper surface of the oxide layer.

Moore does not teach these limitations. Specifically, Moore teaches that the gate electrode 26 contacts the intervening silicon nitride layer 24. In the structure disclosed in Moore, the silicon nitride layer 24 is disposed between the oxide layer 18 and the gate electrode 26. Therefore, because of the presence of the intervening silicon nitride

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layer 24, Moore does not teach that "the gate electrode contacts the upper surface of the oxide layer," as recited in amended Claim 9.

In view of the foregoing, Applicants submit that Moore does not anticipate Claim 9, and therefore respectfully suggest that Claim 9 is allowable over Moore. Furthermore, because Claims 10 and 15 depend from Claim 9, Applicants submit that Claims 10 and 15 are allowable over Moore for the same reasons that Claim 9 is allowable over Moore, in addition to reciting further distinguishing features of particular utility. Thus, Applicants respectfully request that these rejections be withdrawn.

Claim Rejections Under 35 U.S.C. § 103.

Claims 2, 3 and 11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Moore in view of U.S. Patent 6,297,539 ("Ma"). Claims 2 and 3 depend from Claim 1; Claim 11 depends from Claim 9. Ma does not provide the deficiencies of Moore. Because Claims 2 and 3 depend from Claim 1, Applicants respectfully submit that Claims 2 and 3 are allowable for the same reasons explained above with respect to Claim 1, in addition to reciting further distinguishing features of particular utility. Because Claim 11 depends from Claim 9, Applicants respectfully submit that Claim 11 is allowable for the same reasons explained above with respect to Claim 9, in addition to reciting further distinguishing features of particular utility. Thus, Applicants respectfully request that these rejections be withdrawn.

Claims 4-6 and 12-14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Moore in view of Ma and U.S. Patent 6,727,148 ("Setton"). Claims 4-6 depend from Claim 1; Claims 12-14 depend from Claim 9. The combination of Ma and Setton does not provide the deficiencies of Moore. Because Claims 4-6 depend from Claim 1, Applicants respectfully submit that Claims 4-6 are allowable for the same reasons explained above with respect to Claim 1, in addition to reciting further distinguishing features of particular utility. Because Claims 12-14 depend from Claim 9, Applicants respectfully submit that Claims 12-14 are allowable for the same reasons explained above with respect to Claim 9, in addition to reciting further distinguishing

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features of particular utility. Thus, Applicants respectfully request that these rejections be withdrawn.

Claims 7 and 8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Moore in view of U.S. Patent 6,744,104 ("Aoki"). Claims 7 and 8 depend from Claim 1. Aoki does not provide the deficiencies of Moore. Because Claims 7 and 8 depend from Claim 1, Applicants respectfully submit that Claims 7 and 8 are allowable for the same reasons explained above with respect to Claim 1, in addition to reciting further distinguishing features of particular utility. Thus, Applicants respectfully request that these rejections be withdrawn.

Conclusion

In view of the foregoing amendments, the Applicants submit that this application is in condition for allowance, and respectfully request the same. If, however, some issue remains that the Examiner feels can be addressed by an Examiner's Amendment, the Examiner is cordially invited to call the undersigned for authorization.

Respectfully submitted,

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Dated: 28 sep 04

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